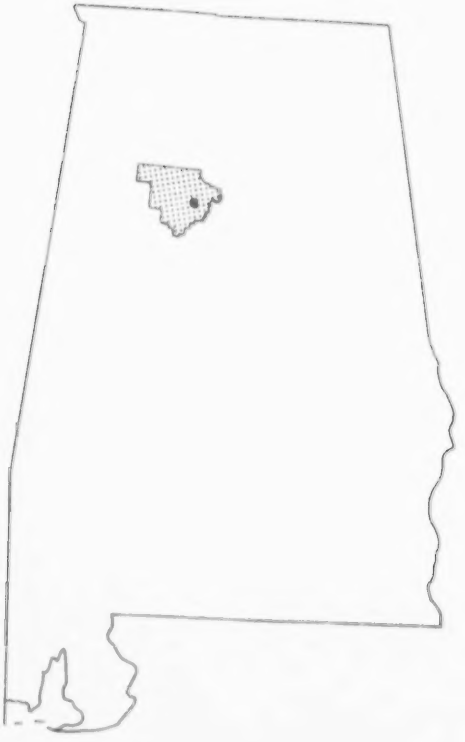
010205

# FLOOD INSURANCE STUDY

## CITY OF CORDOVA, ALABAMA
WALKER COUNTY



SEPTEMBER 16, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 010205

FEMA 209

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

# 1.0 INTRODUCTION

## 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Cordova, Walker County, Alabama and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Cordova to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

## 1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers Mobile District Office and reviewed by Law Engineering Testing Company for the Federal Insurance Administration, under Contract No. H-4636. This study was completed in July 1979.

## 1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of Law Engineering Testing Company, FIA, and representatives of the City of Cordova in February 1978. Results of the hydrologic analyses were coordinated with the U.S. Army Corps of Engineers (COE).

On April 11, 1980, the results of the study were reviewed at the final meeting attended by representatives of Law Engineering Testing Company, FIA, and community officials. The study was acceptable to the community.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Cordova, Walker County, Alabama. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed and approximate studies in Cordova were determined by FIA with community and study contractor consultation at the meeting in February 1978.

Floods caused by overflow of the Mulberry Fork of the Black Warrior River from the downstream corporate limit of Cordova to the upstream corporate limit were studied in detail. In addition, Cane Creek, from its confluence with Mulberry Fork to near the upstream corporate limits of Cordova, was also studied in detail. Flooding on Frog Ague Creek within the corporate limits was studied by approximate methods.

Approximate methods of analyses were used to study those areas having a low development potential or a minimal flood hazard.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through 1983.

### 2.2 Community Description

The City of Cordova is located in the southeastern section of Walker County, Alabama at the confluence of Cane Creek and the Mulberry Fork of the Black Warrior River. The community encompasses an area of approximately 4 ½ square miles and as of the 1970 census, has a population of 2,750 (Reference 1).

The stream flow in Walker County, except for the northwest corner, is in a southeasterly direction into the Mulberry Fork of the Black Warrior River. Cane Creek and Frog Ague Creek flow through Cordova and empty into the Mulberry Fork.

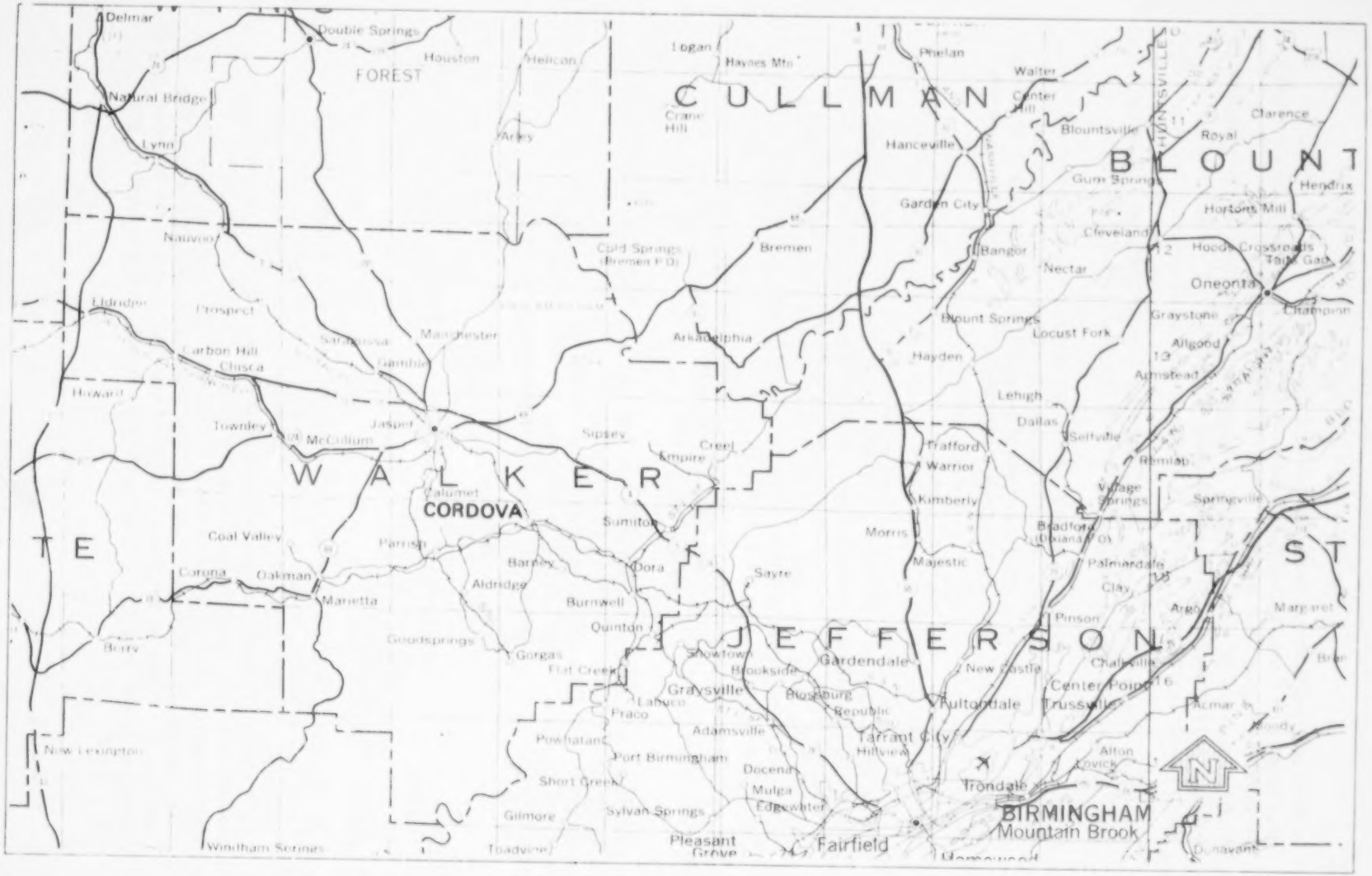



FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

# CITY OF CORDOVA, AL

(WALKER CO.)

APPROXIMATE SCALE

8 0 8 16 24 MILES

## VICINITY MAP

In the Cordova Planning Area, approximately 83 percent of all land is undeveloped. This area includes agricultural land, forests, water courses and impoundments and open spaces. Industrial and residential lands make up about 10 percent of the total area. The major industries in Cordova include Allied Steel Products Corporation of Alabama, Cordova Mills, Inc., and Vulcan Asphalt Refinery Company, Inc.

The major transportation ways in Cordova are the Southern and St. Louis-San Francisco Railways, along with County Roads 22, 30 and 61.

Cordova lies in a region of temperate climate with relatively mild winters and a mean annual temperature of approximately 62.5 degrees F. The area is characterized by negligible snowfall; rainfall averages approximately 54 inches per year. Relative humidity averages about 70 percent (Reference 1).

## 2.3 Principal Flood Problems

Major flood producing storms in the Cordova area usually occur during winter and spring; however; thunderstorms may cause local flooding at any time. Since the construction of Lewis M. Smith Dam in 1961 (see Section 2.4), there have been no serious floods in Cordova. Comparisons with past flood stages and possible future flood stages at the Cordova gage on Mulberry Fork follow (Reference 2):

Flood Stages at Cordova Gage
on Mulberry Fork

| Flood | Stage (ft) | Elevation (NGVD) |
|---|---|---|
| 2/23/61 | 27.5 | 271.1 |
| 4/13/64 | 20.4 | 264.0 |
| 12/26/73 | 22.8 | 266.4 |
| **4/13/79** | **23.7** | **267.3** |
| 10-yr. | 24.9 | 268.5 |
| 50-yr. | 33.1 | 276.7 |
| 100-yr. | 36.7 | 280.3 |
| 500-yr. | 45.6 | 289.2 |

## 2.4 Flood Protection Measures

Smith Dam is located 27 miles upstream of Cordova in Walker and Cullman Counties, Alabama, on Sipsey Fork, a tributary of Mulberry Fork and a headwater stream of the Black Warrior River system. The dam is owned by Alabama Power Company and was constructed for the purpose of providing reservoir capacity for the generation of hydro-electric power and flood control. Constructed in 1961, it controls 944 square miles of the 1927 square mile Mulberry Fork drainage basin upstream of Cordova (Reference 2). There is 280,600 acre feet of storage available for flood control between power pool (El. 510) and spillway crest (El. 522) elevations (Reference 3).

Operation of the Lewis Smith Dam and Reservoir for flood control will result in appreciable reduction in the magnitude of flood peaks at Cordova and have been considered in this analysis.

## 3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

### 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Stream flow records were not available for Cane Creek therefore, a flood flow frequency analysis conducted by the COE, MDO, was adopted (Reference 4). This analysis was also used to develop flows for Mulberry Fork, taking into consideration the operation of Smith Dam. Results of the hydrologic analyses are presented in Table 1, "Summary of Discharges" (Reference 2).

TABLE 1 - SUMMARY OF DISCHARGES

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (sq. miles) | PEAK DISCHARGES (cfs) 10-YEAR | 50-YEAR | 100-YEAR | 500-YEAR |
|---|---|---|---|---|---|
| MULBERRY FORK | | | | | |
| Cordova gage (Sta. 2-4535) | 1927 | 62,000 | 95,000 | 112,000 | 160,000 |
| CANE CREEK | | | | | |
| at the mouth | 64 | 6,500 | 9,000 | 10,000 | 12,600 |

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in Cordova were carried out by the COE, and the results adopted to this study. The purpose was to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

Cross sections for the backwater analyses of Mulberry Fork and Cane Creek were obtained from aerial photographs flown in January 1977. The below-water sections were obtained by field measurement. All bridges, and culverts were field checked to obtain elevation data and structural geometry.

The locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For streams for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations, were chosen by engineering judgement and based on field observations of the streams and flood plain areas. Roughness values used for Cane Creek and Mulberry Fork ranged from 0.026 to 0.035 for the channel, and 0.12 for the overbank areas.

Water-surface elevations for floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 5). Flood profiles were drawn showing computed water surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Cane Creek were calculated using the slope-area method. Starting water-surface elevations for Mulberry Fork were obtained by transferring the Cordova gage information to the initial cross section near the Southern Railway bridge, taking into account the slope of the river channel. All elevations are referenced from the National Geodetic Vertical Datum of 1929, (NGVD) formerly reference to as Sea Level Datum of 1929; elevation reference marks used in this study are shown and described on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

## 4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

### 4.1 Flood Boundaries

In order to provide a national standard without regional discrimination the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is used to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the flood elevations at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:6000 with a contour interval of 5 feet (Reference 6). In cases where the 100-year and the 500-year boundaries are close together, only the 100-year boundary has been shown.

For the streams studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations, the topographic maps referenced above, and information provided by residents along the study streams. The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations, and therefore, may not be subject to flooding; owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

### 4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without

substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, widths were interpolated and boundaries drawn. In cases where the floodway and the 100-year boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FT.) | SECTION AREA (SQ. FT.) | MEAN VELOCITY (F.P.S.) | REGULATORY (NGVD) | WITHOUT FLOODWAY (NGVD) | WITH FLOODWAY (NGVD) | INCREASE (FEET) |
| Mulberry Fork | | | | | | | | |
| A | 14,600 | 495[2] | 14,489 | 7.7 | 279.4 | 279.4 | 280.4 | 1.0 |
| B | 17,410 | 1,105[2] | 20,765 | 5.4 | 280.2 | 280.2 | 281.2 | 1.0 |
| C | 18,060 | 554[2] | 17,108 | 6.5 | 280.4 | 280.4 | 281.4 | 1.0 |
| D[3] | 20,475 | 669 | 18,970 | 5.9 | 280.9 | 280.9 | 281.9 | 1.0 |
| Cane Creek | | | | | | | | |
| A | 880 | 107[2] | 1,781 | 5.6 | 280.5 | 259.7[4] | 260.7 | 1.0 |
| B | 2,420 | 115[2] | 1,742 | 5.7 | 280.5 | 260.6[4] | 261.5 | 0.9 |
| C | 5,220 | 388[2] | 3,716 | 2.7 | 280.5 | 262.2[4] | 263.0 | 0.8 |
| D | 8,985 | 327[2] | 3,468 | 2.9 | 280.5 | 263.6[4] | 264.6 | 1.0 |
| E | 12,740 | 211[2] | 2,265 | 4.4 | 280.5 | 265.4[4] | 266.4 | 1.0 |
| F | 14,890 | 372[2] | 4,728 | 2.1 | 280.5 | 267.0[4] | 268.0 | 1.0 |
| G | 15,050 | 86[2] | 1,664 | 6.0 | 280.5 | 267.0[4] | 268.0 | 1.0 |
| H | 19,440 | 934[2] | 8,793 | 1.1 | 280.5 | 268.4[4] | 269.4 | 1.0 |
| I | 21,550 | 534[2] | 5,146 | 1.9 | 280.5 | 268.7[4] | 269.7 | 1.0 |

[1] Feet above Southern Railway Bridge for Mulberry Fork; feet above confluence with Mulberry Fork for Cane Creek
[2] This width extends beyond the Corporate Limits
[3] Outside Corporate Limits, not shown on map
[4] Water-surface elevations determine without considering backwater effects from Mulberry Fork

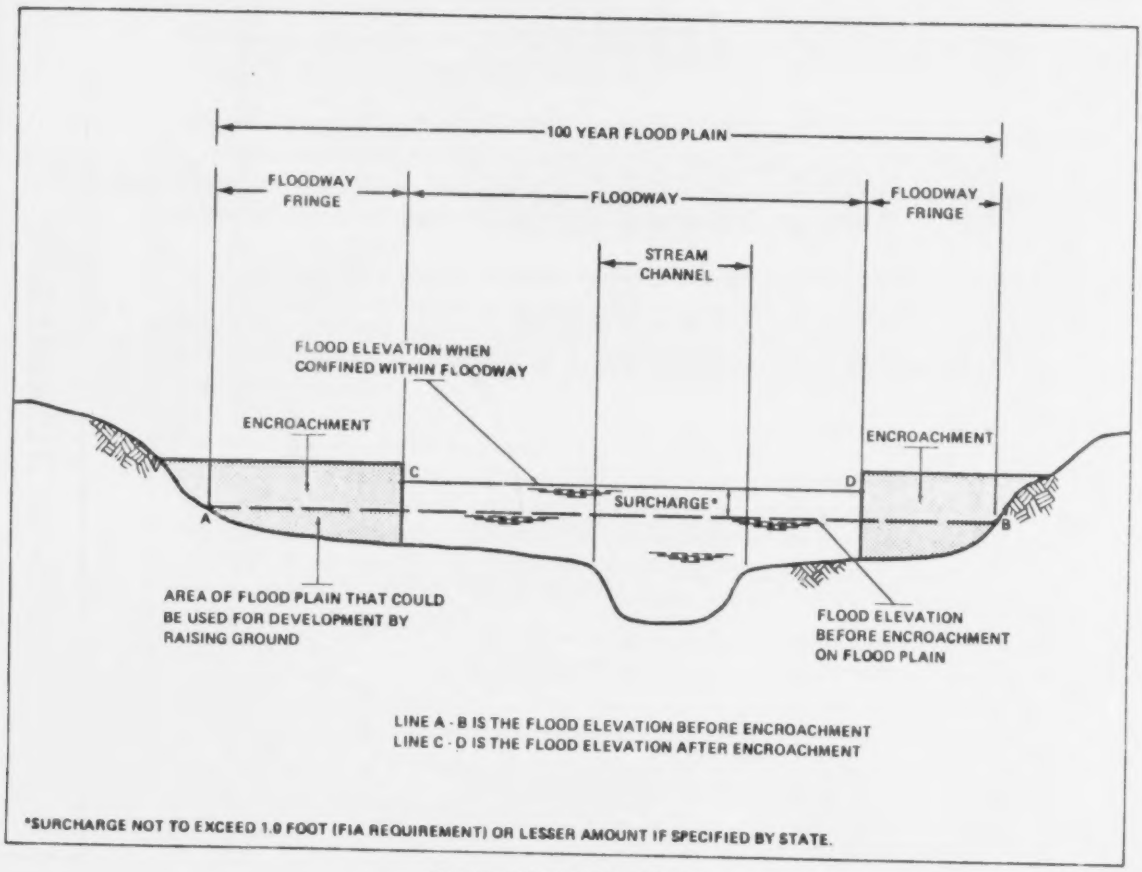
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

# CITY OF CORDOVA, AL
(WALKER CO.)

## FLOODWAY DATA

## MULBERRY FORK--CANE CREEK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
A
B
SURCHARGE*
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC

Figure 2

## 5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source studied in detail affecting the City of Cordova.

## 5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

| Average Difference Between 10- and 100-Year Floods | Variation |
|---|---|
| 2-7 feet | 1.0 foot |
| 7.1-12 feet | 2.0 feet |

One reach meeting these criteria was required for the flooding sources of the City of Cordova. This includes one reach for Mulberry Fork. The location of the reach is shown on the Flood Profile (Exhibit 1).

## 5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

## 5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Cordova was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.

| | |
|---|---|
| Zones A22: | Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHFs. |
| Zone B: | Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided. |
| Zone C: | Areas of minimal flooding. |

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

### 5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Cordova is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

## 6.0 OTHER STUDIES

The COE, Mobile District Office, is presently in the process of publishing a Special Flood Hazard Information Report for the City of Cordova. Since this Flood Insurance Study was based on the COE information and analyses, there should be no conflicting results.

## 7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, 1375 Peachtree Street, N.E., Suite 778, Atlanta, Georgia 30309.

| FLOODING SOURCE | PANEL[1] | ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND | | | FHF | ZONE | BASE FLOOD ELEVATION[3] |
|---|---|---|---|---|---|---|---|
| | | 10% (10 YR.) | 2% (50 YR.) | 0.2% (500 YR.) | | | |
| Mulberry Fork Reach 1 | 0001 | -11.7 | -3.6 | +9.1 | 120 | A22 | Varies |

[1] FLOOD INSURANCE RATE MAP PANEL
[2] WEIGHTED AVERAGE
[3] ROUNDED TO NEAREST FOOT – SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
CITY OF CORDOVA, AL
(WALKER CO.)

FLOOD INSURANCE ZONE DATA

MULBERRY FORK

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2. U.S. Army Corps of Engineers, Mobile Alabama District Office, "Special Flood Hazard Information Report - Mulberrry Fork and Cane Creek, Cordova, Walker County, Alabama:" (unpublished).

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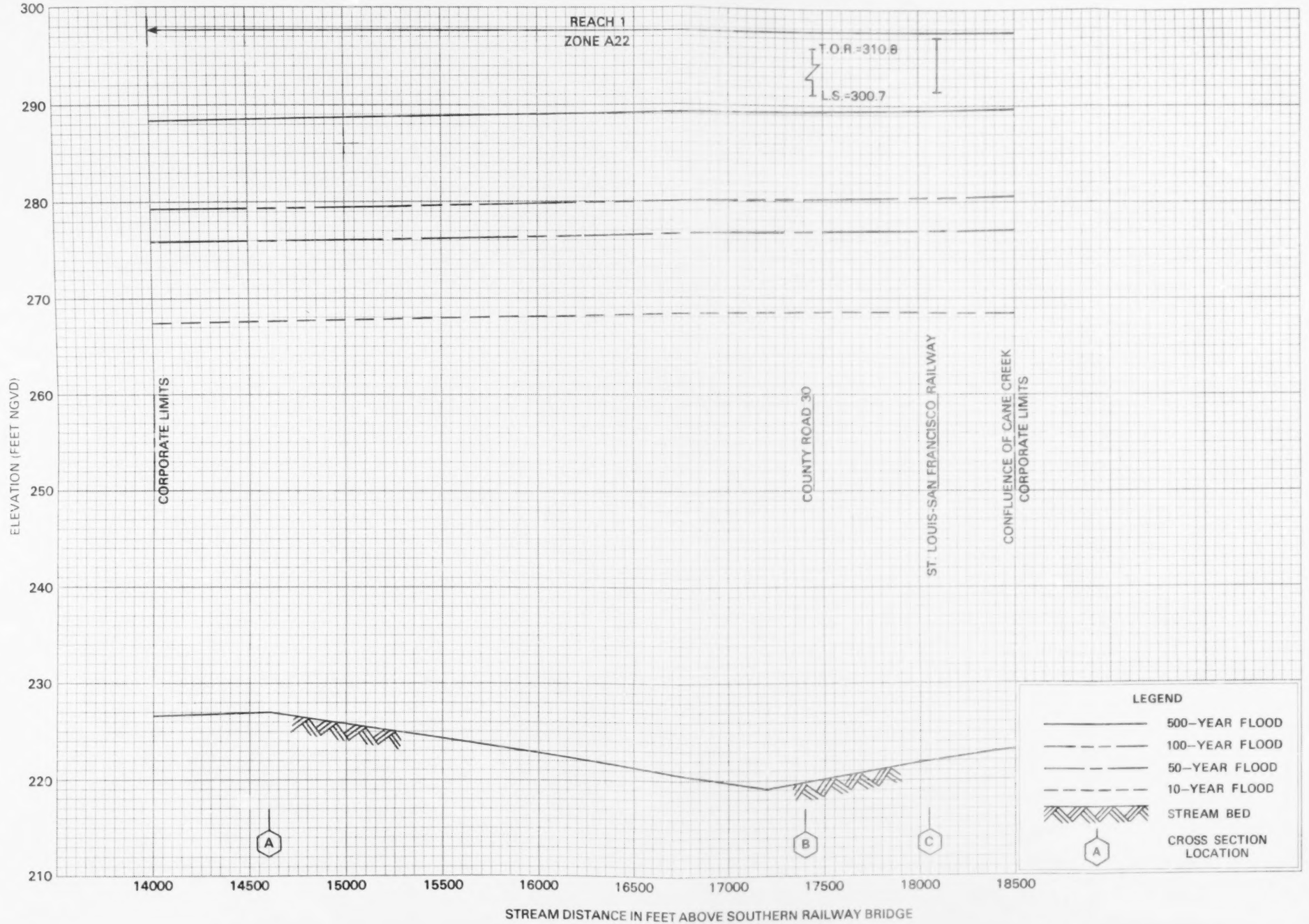


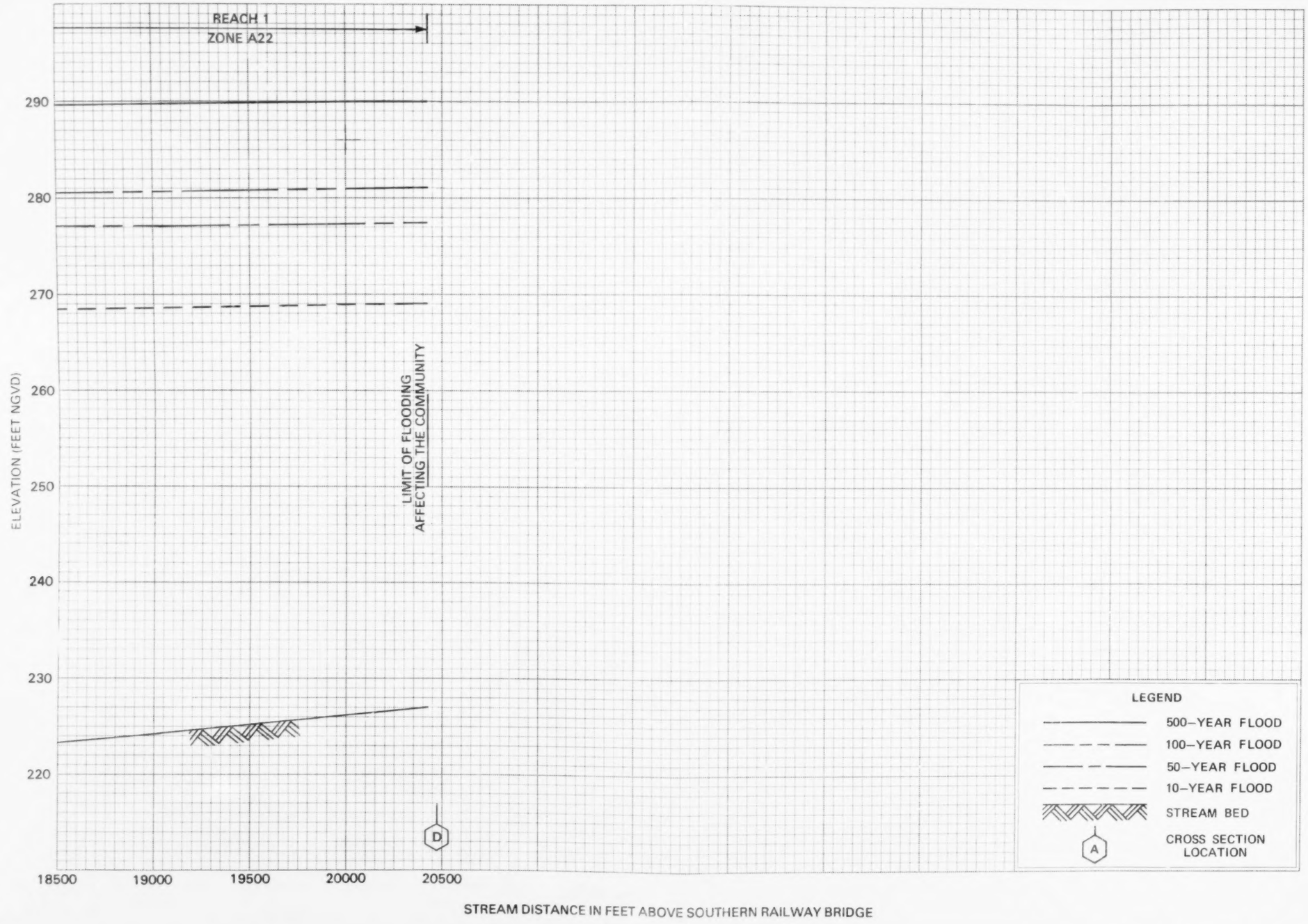

FLOOD PROFILES

MULBERRY FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CORDOVA, AL
(WALKER CO.)

01P



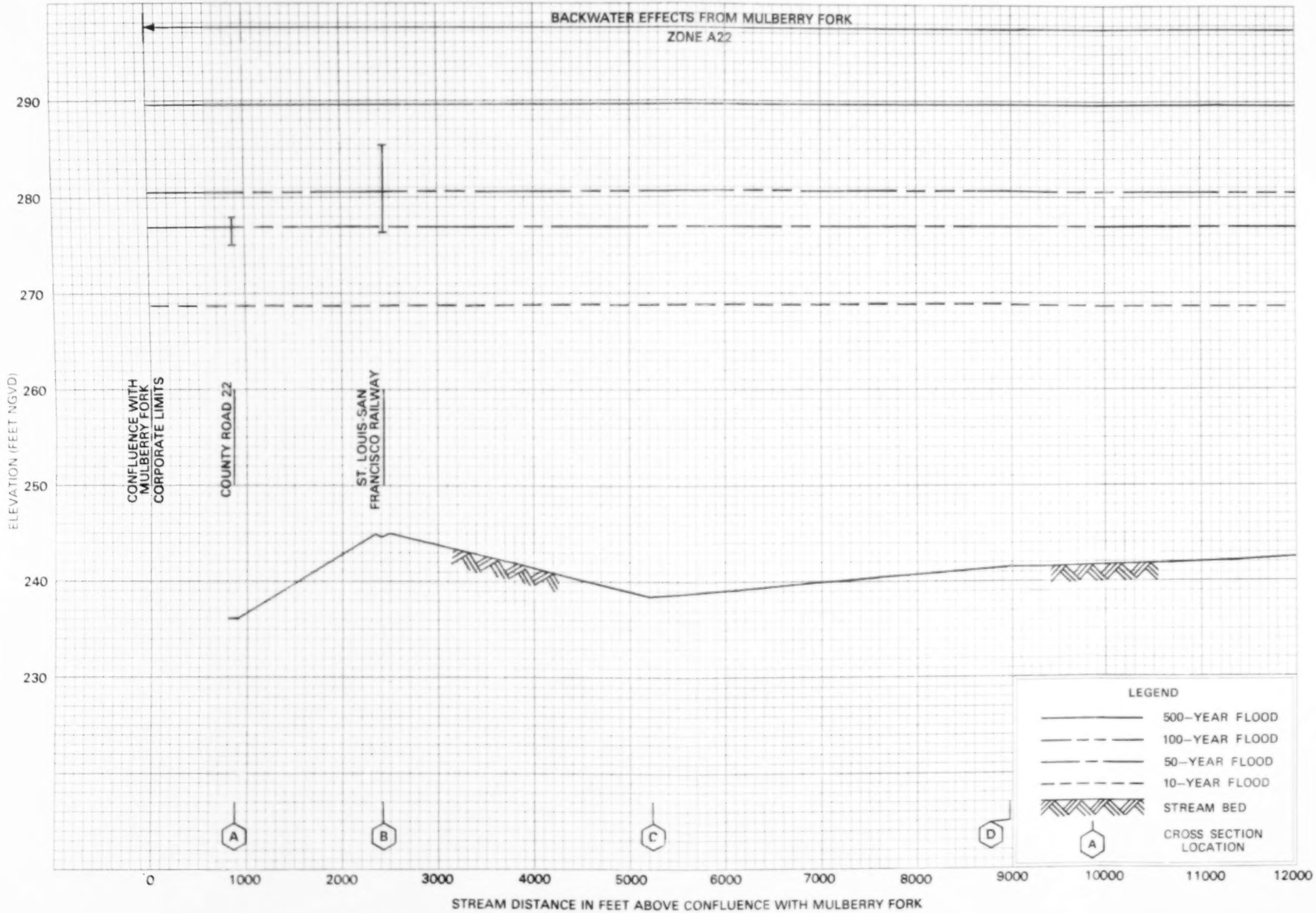

FLOOD PROFILES

MULBERRY FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CORDOVA, AL
(WALKER CO.)

02P



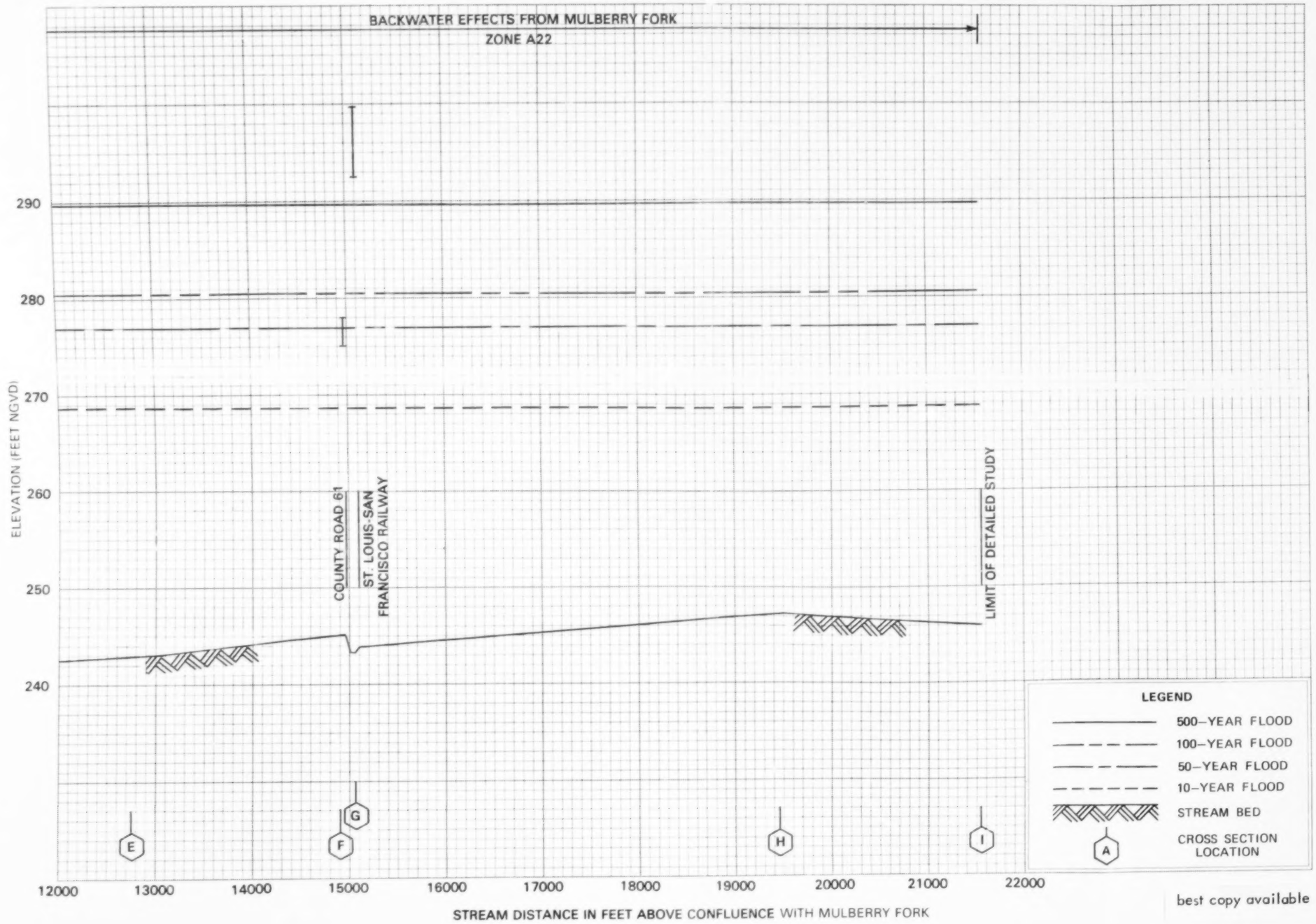

FLOOD PROFILES

CANE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CORDOVA, AL
(WALKER CO.)

03P

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FLOOD PROFILES

CANE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CORDOVA, AL
(WALKER CO.)

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